Framework conditions and public regulation for wind turbines in the Øresund Region

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1. Introduction

In both Sweden and Denmark objectives for introducing more renewable energy including wind power production into the energy system have been drawn by the governments. In Denmark the objective is to increase the amount of renewable energy to 33% in 2020 and in Sweden the objective is 49% renewable energy in 2020 (Danish Government, 2011), (Swedish Government, 2011).

The price of the electricity produced by wind turbines is one of the crucial factors if an increased amount of wind power production has to be implemented and it is therefore necessary to support the owners of the wind turbines economically. However, there is a difference between the form of support achieved in Sweden and in Denmark, which will be described below. Further to a description of organization and ownership, other framework conditions and key requirements for setting up wind turbines will be carried out. The paper will only describe the conditions in Denmark and Sweden without making any comparisons.

2. Framework conditions – subsidies

The payment for electricity produced by wind turbines is done by using the Nordic trade market called Nordpool. Because of the large amount of hydro power in Sweden and Norway, the prices on Nordpool may vary according to the amount of rain in one year. The market price for wind power is therefore dependent on whether it is a dry or wet year (Danish Wind Turbine Owners' Association, 2009).

2.1. Danish framework

Power produced by wind turbines in Denmark is accounted for with the market price (Nordpool) and an additional subsidy because of the added environmental and socioeconomic value from wind production. The subsidy is the difference between the tariffs given to the producer and the market price (Munksgaard & Morthorst, 2008). The subsidies may however vary according to when a specific wind turbine was connected to the grid and whether it is part of the so called scrapping scheme for wind turbines, expiring at the end of 2011. Tables of the existing subsidies and their duration can be seen below in four different categories; onshore wind turbines, offshore wind turbines, wind turbines connected to their own consumption installation and subsidies according to the scrapping scheme. The prices are in DKK.

Subsidies for onshore wind turbines:

Grid connection	Subsidies	Duration of subsidies	Exceptions of subsidies
By 21st February 2008 or later	25 + 2,3 øre/kWh (surcharges + balancing costs)	22.000 full load hours	Wind turbines connected to their own consumption installation and offshore wind turbines
Between 20th February 2008 and 31st December 2002	10 + 2,3 øre/kWh (surcharges + balancing costs)	20 years	Power plant funded wind turbines which are grid connected by 31st December 1999.
By 31st December 2002:	Subsidy and market price must collectively be 60 øre/kWh. If the amount of power is produced within 10 years the subsidy and market price will change to collectively 43 øre/ kWh. If the amount of power is not produced within 10 years the subsidy and market price will change to collectively 27 øre/ kWh.	10 years (subsidy period will expire by 31st December 2012)	Wind turbines connected to their own consumption installation or funded by a power plant
200 kW or below		25.000 full load hours	
201 kW to 599 kW		15.000 full load hours	
600 kW and higher		12.000 full load hours	
From 1st January 2000 and forewords	Subsidy and market price must collectively be 33 øre/kWh + 10 øre/kWh subsidy	10 years	Only for Wind turbines funded by power plants

Subsidies for offshore wind turbines:

The subsidies for offshore wind farms are different for each park and is decided by the government in conjunction with the bidding round. There are nine wind farms in Denmark and some of the newest wind farms are listed in the table below.

Grid connection	Subsidies	Duration of subsidies	Exceptions of subsidies
Horns Rev 1, established in 2002	Subsidy is adjusted, so subsidy and market price collectively is 33 øre/kWh	10 years	
Horns Rev 2, offered 7th July 2004	Subsidy is adjusted, so subsidy and market price collectively is 51,8 øre/kWh**	Power production on 10 TWh, however maximum 20 years from time of grid connection	
Rødsand 2, offered 7th February 2008	Subsidy is adjusted, so subsidy and market price collectively is 62,9 øre/kWh**	Power production on 10 TWh, however maximum 20 years from time of grid connection	
Anholt, offered 30th April 2009	Subsidy is adjusted, so subsidy and market price collectively is 1,05 øre/kWh	Power production on 10 TWh	
From 1st January 2000 or later	Subsidy and market price must collectively be 35,3 øre/kWh + 10 + 0,7 øre/kWh (surcharges and addition to feed-in tariff)	42.000 full load hours	

** If the producer has to pay a feed-in tariff, there is an additional surcharge equivalent to the payment of the fixed feed-in tariff

Subsidies for wind turbines connected to their own consumption installation with a capacity of 25 kW or lower:

Grid connection	Subsidies	Duration of subsidies	Exceptions of subsidies
Not determined	Subsidy and market price must collectively be 60 øre pr. kWh	Not determined	Is only for wind turbines connected to their own consumption installation

Subsidies according to scrapping scheme:

Grid connection	Subsidies	Duration of subsidies	Exceptions of subsidies
From 21st February 2008 to 31st December 2010	8 øre pr. kWh	12.000 full load hours	Wind turbines with an effect of more than 450 kW are not supported by the scheme. Nor is offshore wind turbines and turbines connected to their own consumption installation
From 1st January 2005 to 20th February 2008	12 øre pr. kWh	12.000 full load hours	Wind turbines with an effect of more than 450 kW are not supported by the scheme. Nor is offshore wind turbines and turbines connected to their own consumption installation
From 1st April 2001 to 1st January 2004	17 øre pr. kWh	12.000 full load hours	Wind turbines with an effect of more than 150 kW is not supported by the scheme

Source for tables: (Danish Government, 2008, s. §§ 36-42)

Besides above listed subsidies there is a green fund, which was created by the "Act of promoting renewable energy" in 2008, which can contribute to financing activities that will increase the local acceptance of setting up new windmills. The funding will be 0,4 øre/kWh for the first 22.000 full load hours. Municipalities may also apply for support from this green fund (Danish Government, 2008, s. § 18).
Further a guarantee fund has been established to secure loans for preliminary investigations about the possibilities of setting up wind turbines carried out by windmill guilds. The decision of support is made by the TSO Energinet.dk (Danish Government, 2008, s. § 21).

The minister of climate and energy may establish rules regarding how the costs of connecting wind turbines to the grid will be divided between the owner of the wind turbine and public electricity companies (Danish Government, 2008, s. § 30, stk. 1, pkt. 3). The costs of connection to the grid onshore in terms of extensions or reinforcements of the grid are being born by the grid operator. Offshore the grid company must pay for connecting the grid to the wind turbines nearest collection point. (Danish Government, 2011, s. chapter 2)

2.2. Swedish framework

In Sweden there is a different way of supporting the wind turbine owners, by using the so called green certificates, which is both supporting onshore and offshore wind power production.

Onshore wind power:
The green certificates were introduced in 2003 and expire in 2035 and are aiming to secure a predetermined market-share for renewable energy production and to establish a cost-effective competition between the different sorts of renewable energy sources (Söderholm & Petterson, 2011). This scheme is thus technology-neutral supporting the mature technologies on the market and not preferring any sorts of renewable energy sources. The producers of renewable energy are entitled to electricity certificates for a maximum period of 15 years. Further, there exists an annual obligation on the part of electricity suppliers to hold electricity certificates according to their use and sale the last year. The producers of renewable electricity receive a certificate for every MWh of electricity produced and may sell these if they want to. This should provide an incentive for the producers to produce more renewable energy (Ministry of sustainable development, 2006). The scheme has since 2003 supported the production of renewable electricity with around 20-30 Euro per. MWh in addition to the market price, varying from year to year, and has in Sweden been a key driver behind the expansion of wind power since 2006 (Söderholm, Pettersson, Ek, & Söderholm, 2010). However, other assessments have shown that renewable energy production will also be dependent on financial support to be economical in the future because of the increased supply of energy production, especially from wind power (Svensk vindenergi, 2008).

Offshore wind power:
In Sweden two types of policy instruments may support the establishment of new offshore wind capacity. The first is the green certificates, supporting both on- and offshore wind turbine developments, and the second is an investment subsidy to pilot projects. The investment programme for pilot projects is not only for offshore wind projects, but aiming at supporting large scale technological development in wind power. This could often be investments in offshore wind farms, as was the case when establishing the Lillgrund wind farm. The current certificate system has however turned out to be far from adequate to make investments in offshore wind power an economically attractive alternative in Sweden (Söderholm & Petterson, 2011).

The grid operator is entitled to charge a fee on connection to the grid corresponding to the costs of the work that must be carried by connecting the wind power installation. Further the grid operator may charge a fee for the transmission of the electricity according to energy losses, maintaining and operating the grid (Swedish energy agency, 2008)

It is important to stress that not only support schemes, but also decision-making structures, legal permitting structures and planning systems have an important role in the process of setting up new wind turbines (Söderholm, Pettersson, Ek, & Söderholm, 2010).

3. Legislation regarding organization and ownership

3.1. Danish legislation

In 2002 all ownership limitations were lifted in Denmark for wind turbines so anyone can be the owner of a wind turbine today, including citizens, companies and authorities (Danish Wind Turbine Owners' Association, 2001). Municipalities are not only given the overall planning responsibility, but they can also own and develop wind power projects themselves (Sperling, Hvelplund, & Mathiesen, 2010). In Denmark there is a higher degree of cooperative and municipal ownership of power producing units. This has also meant a larger local acceptance of investments in wind power compared to Sweden and other countries (Söderholm, Pettersson, Ek, & Söderholm, 2010).

3.2. Swedish legislation

Swedish law does not provide any specific rules about the right to exploit wind resources, but follows the ownership of the land. The land-owner has the right to use the wind energy resource on his or her property. Further the common water areas, covering the territorial sea and some of the greatest lakes in Sweden, are not owned by any person or the state. No specific legislation is subject to the right of using the water areas for extracting wind energy. Other legislation gives exclusive rights to the state for extracting certain natural resources like minerals but is not including wind resources. On basis of the ownership law, the Swedish state may neither prevent anyone from establishing wind turbines on the water areas nor impose charges for doing so. (Söderholm & Pettersson, 2007)

4. Other framework conditions

A description of how the authority responsibility is divided and the process for the authorities processing the establishment of wind turbines.

4.1. Danish framework

Onshore:

In Denmark the government makes an overall strategy for development of wind power generation and the municipalities are obliged to make land reservations for potential wind turbine locations in the Municipality plan and local plans (Danish Government, 2009, s. § 15a, 5). Because of the planning system, based on framework steering (rammestyring), the national objectives cannot be overlooked by the regions and municipalities.

If the wind turbine is more than 150 m in height the planning competency is delegated to The national environmental centres. An environmental impact assessment has to be carried out if the wind turbine is higher than 80 m or the wind turbine is part of a group of at least three turbines (Danish Wind Turbine Owners' Association, 2009).

Offshore:
The right of exploiting the Danish territorial waters is reserved for the Danish government, who may grant permission for using these areas for wind power production. This permission can be granted to anyone, not only energy companies.
In Denmark the planning of offshore wind turbines begins with the selection of future wind power farm localizations, carried out by the government. These sites are offered in a bidding round where companies can make an offer. The winner of the bidding round is guaranteed a fixed feed-in tariff for a production of 50.000 full load hours (in practice a 12 year period) (Söderholm & Petterson, 2011).

4.2. Swedish framework

Onshore:
For setting up new wind turbines in Sweden you have to follow some certain guidelines for environmental assessment, most importantly the general and specific resource management provisions and for territorial planning (Söderholm & Petterson, 2011). The territorial planning deals with the so-called localization rule, where sites for setting up wind turbines only can be permitted if it is assessed as the best localization from the environments point of view. In this assessment it is not assessed whether this will worsen the conditions for transport and other issues for the producer. Therefore investors of onshore windmills have often met obstacles regarding the legal preconditions for establishing wind power in Sweden. This is due to the legal provisions concerning assessments of environmental impacts, the localization of windmills and public criticism at a local level (Söderholm & Pettersson, 2007). Further windmills have to receive a special building permit given in accordance with the Planning and building act, where the different interests of land-use are being considered. This is mainly a matter for the municipal planning authorities.

The Swedish planning system is based on a decentralized form of decision-making with the municipality planning monopoly as the most decisive factor. Planning for new windmills is mainly a matter for the municipalities which gives the opportunity to ignore national and international energy policy objectives (Söderholm, Pettersson, Ek, & Söderholm, 2010). This also means that the conditions for setting up new wind turbines differ between the regions in Sweden. As (Söderholm, Pettersson, Ek, & Söderholm, 2010) points out, promotion of wind power requires national policies while implementation is a local matter.

Offshore:
Setting up new offshore wind turbines requires two main permits in Sweden - an environmental impact assessment also known as a permit for environmental hazardous activity, and a permit for hydraulic operations. The permit for hydraulic operations may only be approved if the private and social benefits of the project exceed the corresponding costs and damages (Söderholm & Petterson, 2011).

In addition to the above, one final permit may be required (both on and outside Swedish territory), and this concerns the installation of cables on the continental shelf. This permit is also granted by the Government (Söderholm & Petterson, 2011).

5. Key requirements for setting up wind turbines

5.1. Danish requirements

In Denmark several requirements have to be met for granting permission to setting up wind turbines. Some of these are listed in the table below:

Issue	Requirement	Source
Location	Wind turbines should preferably be drawn up in groups	(Danish Government, 2007, s. §2, stk. 1)
Distance to neighbours	There must be minimum a distance of four times the total height of the wind turbine to the nearest neighbouring residential	(Danish Government, 2007, s. §2, stk. 3)
Planning	The local plan must contain provisions regarding the location, number, smallest and largest total height and look of the wind turbine	(Danish Government, 2007, s. § 4, stk. 2)
Compensation for loss in real state	The person who by setting up one or more wind turbines causes a depreciation of real estate must pay for it	(Danish Government, 2008, s. § 6, stk. 1)
Local ownership	The person who is setting up one or more on/offshore wind turbines on at least 25 m, established outside the tender, shall, before drawing begins, offer at least 20% of the ownership shares to turbine neighbours (residence within 4,5 km of the wind turbine location).	(Danish Government, 2008, s. § 13, stk. 1)
Limits for noise	In the most noise-exposed point for outdoor living areas within 15 m from neighbouring residential in open country: - 44 dB(A) at a wind speed of 8 m/s - 42 dB(A) at a wind speed of 6 m/s In the most noise-exposed point for outdoor living areas from noise sensitive land use: - 39 dB(A) at a wind speed of 8 m/s - 37 dB(A) at a wind speed of 6 m/s	(Danish Government, 2006, s. § 3)

5.2. Swedish requirements

In Sweden the person setting up wind turbines has to be granted permission according to the Environmental code and the Planning and building act. The building committees of the municipalities will decide whether the application follows the existing plans and objectives and whether or not to grant permission.

Issue	Requirement	Source
Environmental impact	The person applying for permission for setting up wind turbines must submit an Environmental impact assessment and pay for all associated costs	(Swedish government, 1998, s. chapter 6, section 10)
Building permit	The person applying for permission for setting up wind turbines must apply for a permit according to the provisions in the Building and planning act	(Swedish government, 2006, s. chapter 8)

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